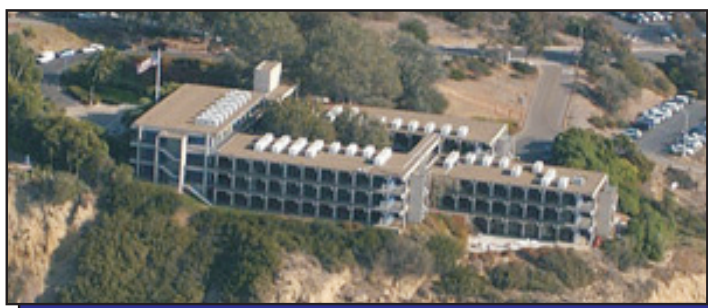


SOUTHWEST FISHERIES SCIENCE CENTER 2005 REPORT

Dr. William W. Fox Jr., Science Director

The Southwest Fisheries Science Center (SWFSC) is the research arm of NOAA's National Marine Fisheries Service in the Southwest Region. Center scientists conduct marine biological, economic and oceanographic research, observations and monitoring on living marine resources and their environment throughout the Pacific Ocean and in the Southern Ocean off Antarctica. The ultimate purpose of these scientific efforts is for the conservation and management of marine and anadromous fish, marine mammal, sea turtle and other marine life populations to ensure that they remain at sustainable and healthy levels.

The Center conducts fisheries and marine mammal research in support of the Pacific Fishery Management Council. In addition to providing scientific advice and technical support for the council, the SWFSC also provides research results in support of many international fisheries commissions and conventions.



La Jolla, California

Center headquarters are located in La Jolla, California, where research is conducted on Pacific and Antarctic fish, marine mammals, sea turtles, and marine habitats. The Center conducts Pacific salmon and groundfish research at a state-of-the-art facility located in Santa Cruz, California. SWFSC researchers located in Pacific Grove, California, study environmental influences on marine resources and provide environmental data to fishery researchers and managers. NOAA ships *David Starr Jordan* and *McArthur II* are platforms for the Center's fishery and protected species field research along the California coast and in the eastern tropical Pacific Ocean.



Pacific Grove, California



R/V David Starr Jordan



Santa Cruz, California

Following are highlights of some of the Center's accomplishments during the past year:

SOUTHWEST FISHERIES SCIENCE CENTER 2005 REPORT

2005 ACCOMPLISHMENTS

California Groundfish Resources Assessed

The past year featured a major effort toward assessing West Coast groundfish resources. Scientists from the Southwest Fisheries Science Center contributed to eight groundfish stock assessments. Three stocks (bocaccio, cowcod, and widow rockfish) are under formal rebuilding plans, and the assessment results showed favorable rebuilding responses in all three cases. Rebuilding analyses indicated that management should “hold the course” though stock rebuilding may still require decades. Five stocks (vermillion, gopher, and shortbelly rockfish, scorpionfish, and starry flounder) were the subjects of first-time stock assessments. All five stocks were found to be currently in a healthy state, but some had passed through a period of lower abundances during the 1990s.

The Center's 2005 juvenile rockfish survey indicates that the danger of decline is not yet past. This survey has been conducted since 1983, and the results for 2005 indicated a very poor reproductive year for rockfishes in central and northern California, though somewhat better conditions were seen to the north and south. Although groundfish seem to be past the consistently unfavorable environmental conditions of the 1990s, the present decade is showing wide fluctuations in reproductive success, including some years as poor as those in the 1990s.



Pacific Sardine Population Surveyed off Oregon and Washington

The expanding population of Pacific sardine supports a substantial new fishery in Oregon, Washington, and as far north as British Columbia. In order to more accurately manage the fishery, a complete data set across the range of the sardine population is needed. In that regard, the Southwest Fisheries Science Center undertook a survey to generate baseline information regarding the northern sardine population, determine fishery-independent estimates of sardine abundance off Oregon and Washington, and estimate the migration rate between Central California



and Oregon-Washington. A total of four surveys were completed off Oregon and Washington over a 2-year period. Preliminary results have given NOAA Fisheries Service scientists insight into the basic parameters of

the sardine population off of Oregon and Washington and have also served as an impetus for further studies on a larger scale. The importance of understanding this sardine population as well as its environment will be a key factor for industry and fisheries management. Plans are underway for a coastwide, Baja California

to British Columbia synoptic survey in April 2006; it is hoped this will be the first survey in a long time series.

SOUTHWEST FISHERIES SCIENCE CENTER 2005 REPORT

Scientists Study Pelagic Sharks in the Eastern Tropical Pacific Ocean

Apex predators of the eastern tropical Pacific (ETP) have long been of national and international diplomatic interest due to the directed harvest of tunas and billfishes and the incidental take of marine mammals, seabirds, and turtles. NOAA Fisheries Service has expended enormous personnel resources and ship time in efforts to study the ecosystem of the ETP and the interactions of marine mammals and tunas. However, almost nothing is known about the biology of large pelagic sharks and their role as a third group of apex predators in the ETP.



Scientists from the Southwest Fisheries Science Center conducted a shark research cruise aboard NOAA ship *David Starr Jordan* to investigate the role of pelagic sharks as apex predators of the ETP, including their species composition, life history, movement patterns, food habits, and physical and biotic environments. This was accomplished primarily by catch-and-release longline sampling and through electronic tagging studies to determine diel vertical movements and long-term horizontal movement patterns. Additional objectives were to correlate the movement

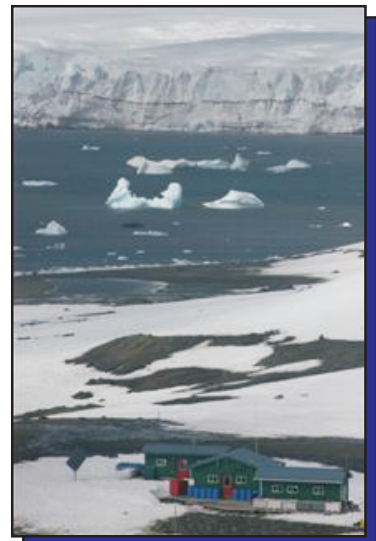
patterns of the sharks with regard to large-scale oceanographic and bathymetric features, and to obtain and archive DNA and tissue samples. In other regions oceanic white-tip shark populations have declined precipitously, and the low encounter rates during this survey indicate that the same may be true in the ETP. This is the first study in the ETP to deploy fin-mounted tags on ocean white-tip sharks, and the Center hopes to gain vital information on their behaviors and migration patterns in this region over the coming months

International Group Developing Assessment Methods for Antarctic Fish Stocks

A subgroup of the Commission for the Conservation of Antarctic Marine Living Resources Working Group on Fish Stock Assessment was chaired in 2005 by Dr. Christopher Jones of the SWFSC's Antarctic Ecosystem Research Division, which manages the U.S. Antarctic Marine Living Resources Program. This working group developed and implemented the first fully integrated modeling framework for toothfish stocks in the Southern Ocean. Precautionary



long-term yields estimated though the use of these new approaches were adopted by the Commission and now serve as conservation measures for setting total allowable catches for toothfish in economically important harvested regions of the Southern Ocean. Dr. Jones will continue to develop work plans and convene the subgroup in 2006.



SOUTHWEST FISHERIES SCIENCE CENTER 2005 REPORT

Scientists Collaborate to Track Loggerhead Turtles

Scientists from the SWFSC are using sophisticated technology to learn more about threatened loggerhead turtles. During 2005, the Marine Turtle Research Group conducted aerial surveys to determine loggerhead abundance and distribution along the Pacific coast of Baja California, Mexico, an area long thought to be critical habitat for juvenile turtles. This project was a joint effort with Mexico's Secretariat of Environment and Natural Resources and conservation organizations. The scientists used a small NOAA aircraft to fly approximately 7,000 km of track line and sight a total of 445 turtles, including loggerhead, olive ridley, green and leatherback turtles. This project was the first large-scale aerial survey for loggerheads in the eastern Pacific Ocean and provided critical new information on their use of marine habitats.



West Coast Ecosystem Survey Focuses on Marine Mammals and Seabirds

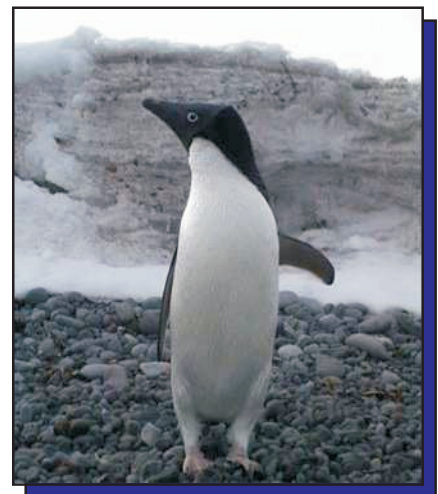
During 2005, the Southwest Fisheries Science Center and the National Marine Sanctuaries Program collaborated on an unprecedented research cruise to assess marine mammals, seabirds, and the pelagic ecosystem along the West Coast of the United States. The project, known as West Coast CSCAPE (Collaborative Survey of Cetacean Abundance and the Pelagic Ecosystem), included comprehensive surveys extending 300 nautical miles offshore, as well as fine-scale coverage in four of the five National Marine Sanctuaries on the West Coast. By combining ship time,



funding, expertise, and personnel, the project maximized the value of the survey and provided valuable opportunities for training, research coordination, and data standardization. The project is expected to result in more precise abundance estimates for marine mammal stock assessments. A secondary objective is to characterize the pelagic ecosystem within the study area through the collection of biological and oceanographic data, seabird studies, and acoustic sampling. Participants in NOAA's Teachers at Sea program joined the cruise and posted weekly reports online.

Tour Ships Help Scientists Estimate Penguin Declines in the Antarctic

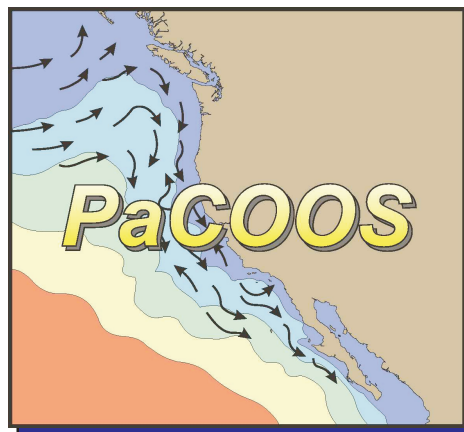
The Antarctic Ecosystem Research Division began a unique collaboration to gather data on penguin population declines throughout the Antarctic Peninsula region. Scientists, in collaboration with the National Science Foundation, the Pew-Lenfest Ocean Program, and Oceanites, have been using the generous support of Lindblad Tours to travel via their ship *Endeavour* to census penguin colonies throughout the Scotia Sea. Research conducted at our long-term NSF/NOAA field camp on King George Island has reported dramatic reductions in the numbers of Adelie and chinstrap penguins that breed there; however, the degree to which these declines represent a "local" change versus a regional-wide decline is unknown. To answer this question, NOAA Fisheries Service scientists are visiting and censusing penguin colonies visited by the tour ship in this region in order to compare recent counts to historical data going back over 50 years in some cases.



SOUTHWEST FISHERIES SCIENCE CENTER 2005 REPORT

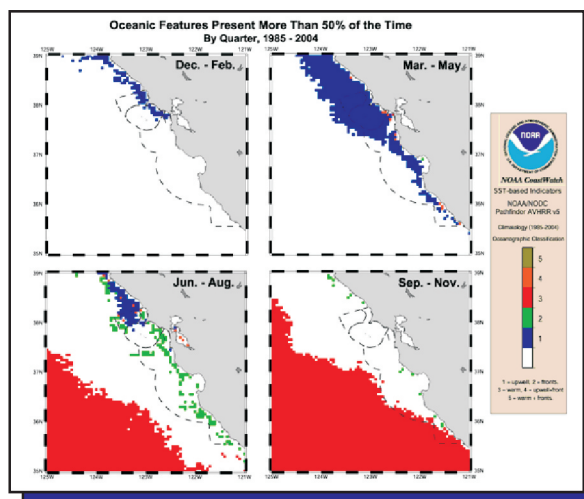
Initiating an Integrated Database System for the West Coast

In 2005, on the recommendation of the Integrated Ocean Observing System (IOOS) Data Management and Communication Committee, NOAA Fisheries Service established a distributed data system, called PaCOOS, to defining data requirements and standards for an integrated ocean observing system on the West Coast. A standardized and integrated data system provides easier access to data for scientists, managers, and other users; creates opportunities to merge different observing system data and develop new syntheses and products; and provides interoperability between data sets that can work within a larger national data system—a system that is currently under development. The Southwest and Northwest Fisheries Science Centers conducted two pilot projects that demonstrated how disparate data of varying formats and from a variety of West Coast sources can be incorporated into a single distributed data system clearly showing how integration and interoperability of data sets can be accomplished. The benefits of integrating regional and national data management systems that combine ecosystem data, such as currents and bathymetry, with fisheries and protected resources data is important to NOAA Fisheries Service's ecosystem approach to management.



Satellite Data Products Will Help Fisheries Decision Makers

Describing the linkages between environmental influences and population variability is important information for regional resource and ecosystem management efforts. Scientists from the Southwest Fisheries Science Center and the Monterey Bay National Marine Sanctuary (MBNMS) are working jointly on providing information on ocean conditions off the Central California coast. MBNMS is using this information in discussions with multiple stakeholders as they deliberate about the formation of marine reserves within sanctuary boundaries. Satellite-based maps depicting the time and space variability of the pelagic ocean habitat were produced, and lay the foundation on how to link science with management issues cooperatively by NOAA.



enhanced data maps will assist regional decision makers in assessing the effects of oceanic variability and climate change on coastal marine resources in Central California. MBNMS will use this information in developing marine protected areas within its boundaries. These products should be useful for NOAA Fisheries Service stock assessments and ecosystem management by NOAA as well.

SOUTHWEST FISHERIES SCIENCE CENTER 2005 REPORT

Film Provided for Reconnaissance Flights of Hurricane Katrina Damage

The U.S. Air Force uses special film to take high-resolution photographs from its optical bar cameras carried on the U-2 aircraft. The Air Force was scheduled to photograph the areas affected by hurricane Katrina using this aircraft to assist the federal and state agencies in their relief efforts but did not have enough film required for the mission. When the manufacturer could not supply the film in time, the Air Force contacted the Southwest Fisheries Science Center, which also uses this particular film with surplus military reconnaissance equipment for its scientific research on protected species, particularly marine mammals and sea turtles. The Center's Photogrammetry Investigation unit was able to provide the Air Force with film from its inventory overnight.



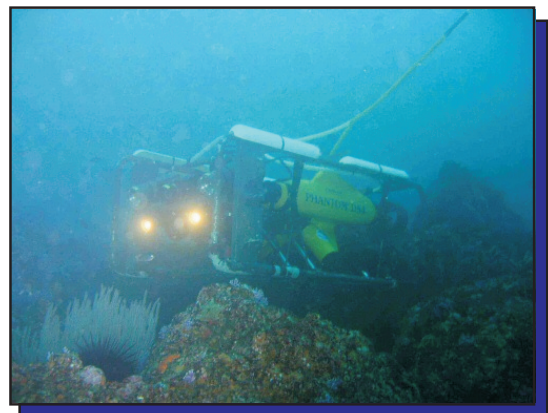
The Photogrammetry Investigation collects high-resolution aerial images of marine mammals and sea turtles. These photographs are used to accurately determine the number of animals present in large aggregations, to identify animals to particular populations based on their body size and shape, and to assess the animals' reproductive and nutritive condition. This technology is used to help recover and monitor large whale populations such as blue, right, and gray whales, to determine the status of depleted dolphin schools in the eastern tropical Pacific that are impacted by the yellowfin tuna purse seine fishery, to determine the abundance of seals and sea lions from California to Alaska, and to study endangered sea turtle populations, like the Pacific leatherback. Because this method collects information remotely, researchers can amass a wealth of data on these protected

species with minimal disturbance to the animals. The success of this program is dependent in a large part on the unique surplus camera systems the Center has obtained from the U.S. military.

Remotely Operated Vehicle Used to Identify Rockfish

Information on cowcod and rockfish populations within the Southern California Bight is limited due to the lack of studies aimed at tracking population densities and fish size distributions over time. The only extensive information available is from intermittent fisheries catch data. NOAA Fisheries Service has taken on the challenge of surveying rockfish populations in a nondestructive manner by developing methods that involve acoustic sonar surveys. This technology has been used for invertebrates and other fish species, but never before for rockfish.

The Southwest Fisheries Science Center surveyed a large part of the Southern California Bight where rockfish densities were known to be high historically, using acoustic methods followed by directed remotely operated vehicle (ROV) surveys. Acoustic surveys were completed aboard NOAA ship *David Starr Jordan* and F/V *Outer Limits* at sites spanning the entire bight. Data were processed immediately so that subsequent ROV surveys on the F/V *Outer Limits* could be completed within the boundaries of acoustic survey areas. ROV surveys were completed at nearly all of the acoustic survey sites, and allowed for fish identification and specific habitat classifications using a combination of still and video imagery. The results of acoustic surveys were represented in 3-dimensional plots, including the ROV transect track lines, and 2-dimensional plots for further interpretation of the scales to be used for fish and habitat

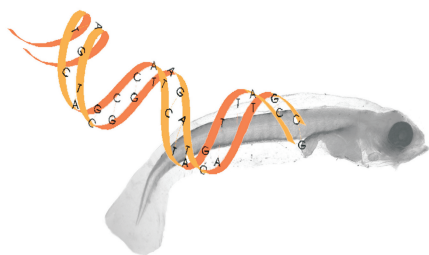


SOUTHWEST FISHERIES SCIENCE CENTER 2005 REPORT

Remotely Operated Vehicle Used to Identify Rockfish (continued)

classifications. Preliminary results suggest agreement between acoustic and ROV survey results for relative fish abundance (i.e., large numbers of fish were observed in ROV surveys where high acoustic returns were recorded, and vice versa). The largest schools of fish were observed in both ROV and acoustic surveys in rocky areas with high relief. Additionally, there was a sufficient amount of habitat data collected during ROV surveys to be used in the construction of acoustic habitat classifications.

Scientists Use New Technique for Molecular Genetic Species Identification



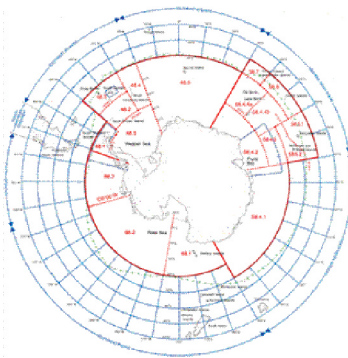
Ichthyoplankton samples provide an excellent time series and are good indicators of environmental shifts and trends in distribution and abundance of a variety of species. Scientists at the Southwest Fisheries Science Center are pioneering a new technique to not only improve our ability to identify ichthyoplankton samples, but to do so in real time, at sea. Samples are collected using bongo tows and a continuous underway fish egg sampler. With an automated molecular

technique, eggs and larvae are processed and identified onboard the ship, within hours of collection. This new method has the potential to screen for thousands of species at once. The new technique will help move fishery management from explanation to forecasting with its ability to quickly identify large quantities of samples. This will become a necessary requirement as the ecosystem approach to management becomes more prevalent and an increased volume of samples related to the Pacific Coast Ocean Observing System come in. Shipboard identification also allows for real-time adaptive sampling, where scientists can preferentially survey an area shown to contain the desired species. This ability to better identify eggs and larvae also gives us an improved understanding of early life history of overfished stocks. In addition, this technique can be used for forensic identification and will make possible egg production estimates for previously unidentifiable species.



Scientist Completes Six Years as Convener of Antarctic Ecosystem Working Group

In 2005, Dr. Roger P. Hewitt of the Southwest Fisheries Science Center completed his six-year term as convener of the Working Group on Ecosystem Monitoring and Management of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Under his tenure, CCAMLR conducted a multi-ship, multi-nation survey for krill in the



Scotia Sea, established small-scale management units for the Antarctic krill fishery, reviewed and updated its ecosystem monitoring protocols, and developed ecosystem models for evaluating fishery management options. This represents one of the first applications of ecosystem-based approaches to fisheries management in the international arena.